# Monitoring VMware virtual infrastructure

## Active IQ Unified Manager 9.11

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# Monitoring VMware virtual infrastructure

Active IQ Unified Manager provides visibility into the virtual machines (VMs) in your virtual infrastructure, and enables monitoring and troubleshooting storage and performance issues in your virtual environment. You can use this feature to determine any latency issues in your storage environment or when there is a reported performance event on your vCenter Server.

A typical virtual infrastructure deployment on ONTAP has various components that are spread across compute, network, and storage layers. Any performance lag in a VM application might occur due to a combination of latencies faced by the various components at the respective layers. This feature is useful for storage and vCenter Server admins and IT generalists who need to analyze a performance issue in a virtual environment and understand in which component the issue has occurred.

You can now access the vCenter Server from the vCenter menu of the VMware section. The peek view of each virtual machine listed has the **VCENTER SERVER** link in the TOPOLOGY VIEW that launches the vCenter Server in a new browser. You can also use the **Expand Topology** button to launch the vCenter Server and click **View in vCenter** button to view the datastores in vCenter Server.

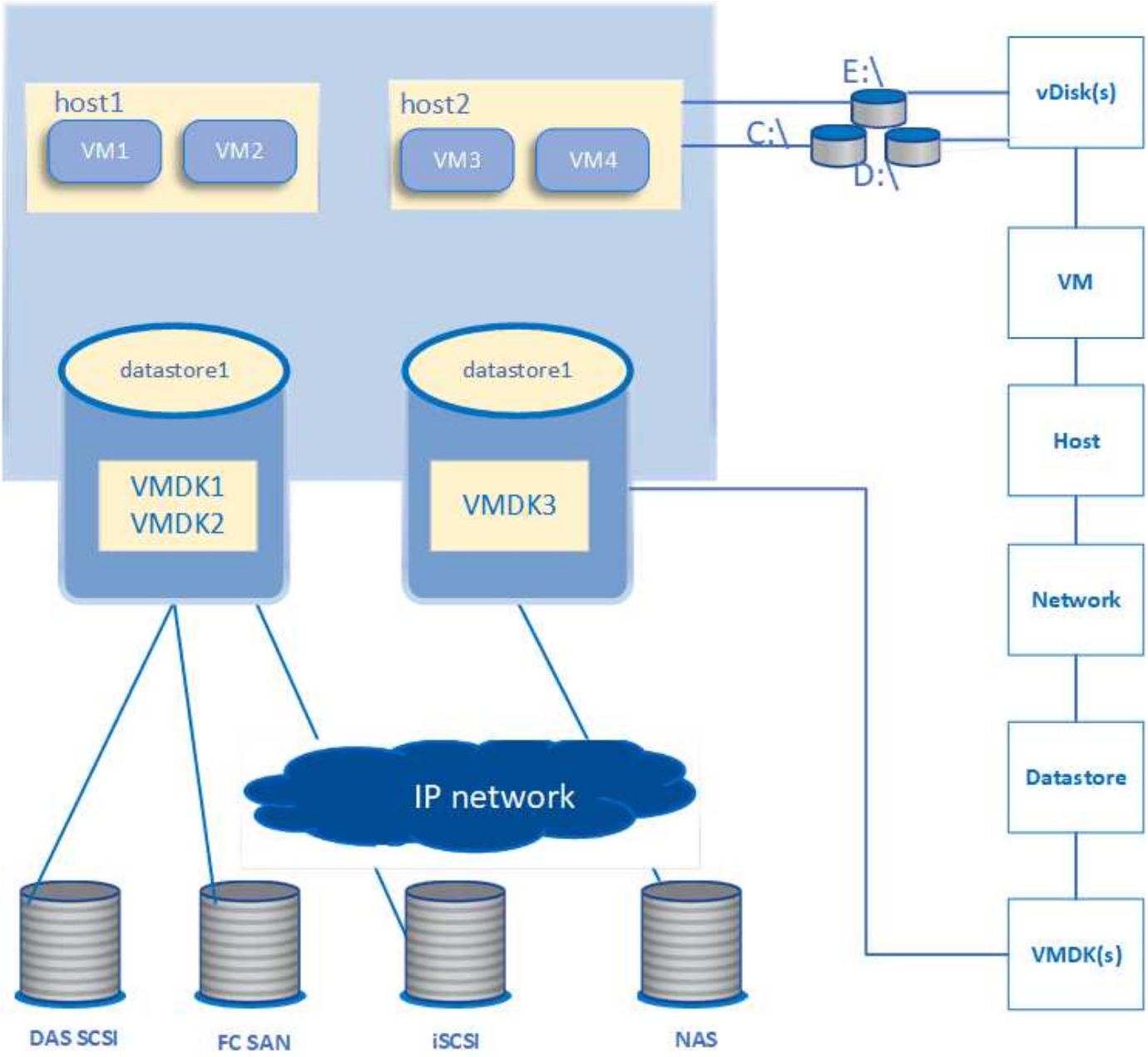
Unified Manager presents the underlying sub-system of a virtual environment in a topological view for determining whether a latency issue has occurred in the compute node, network, or storage. The view also highlights the specific object that causes the performance lag for taking remedial steps and addressing the underlying issue.

A virtual infrastructure deployed on ONTAP storage includes the following objects:

- vCenter Server: A centralized control plane for managing the VMware VMs, ESXi hosts, and all related components in a virtual environment. For more information about vCenter Server, see VMware documentation.
- Host: A physical or virtual system that runs ESXi, the virtualization software from VMware, and hosts the VM.
- Datastore: Datastores are virtual storage objects that are connected to the ESXi hosts. Datastores are manageable storage entities of ONTAP, such as LUNs or volumes, used as a repository for VM files, such as log files, scripts, configuration files, and virtual disks. They are connected to the hosts in the environment via a SAN or IP network connection. Datastores outside of ONTAP that are mapped to vCenter Server are not supported or displayed on Unified Manager.
- VM: A VMware virtual machine.
- Virtual disks: The virtual disks on datastores belonging to the VMs that have an extension as VMDK. Data from a virtual disk is stored on the corresponding VMDK.
- VMDK: A virtual machine disk on the datastore that provides storage space for virtual disks. For each virtual disk, there is a corresponding VMDK.

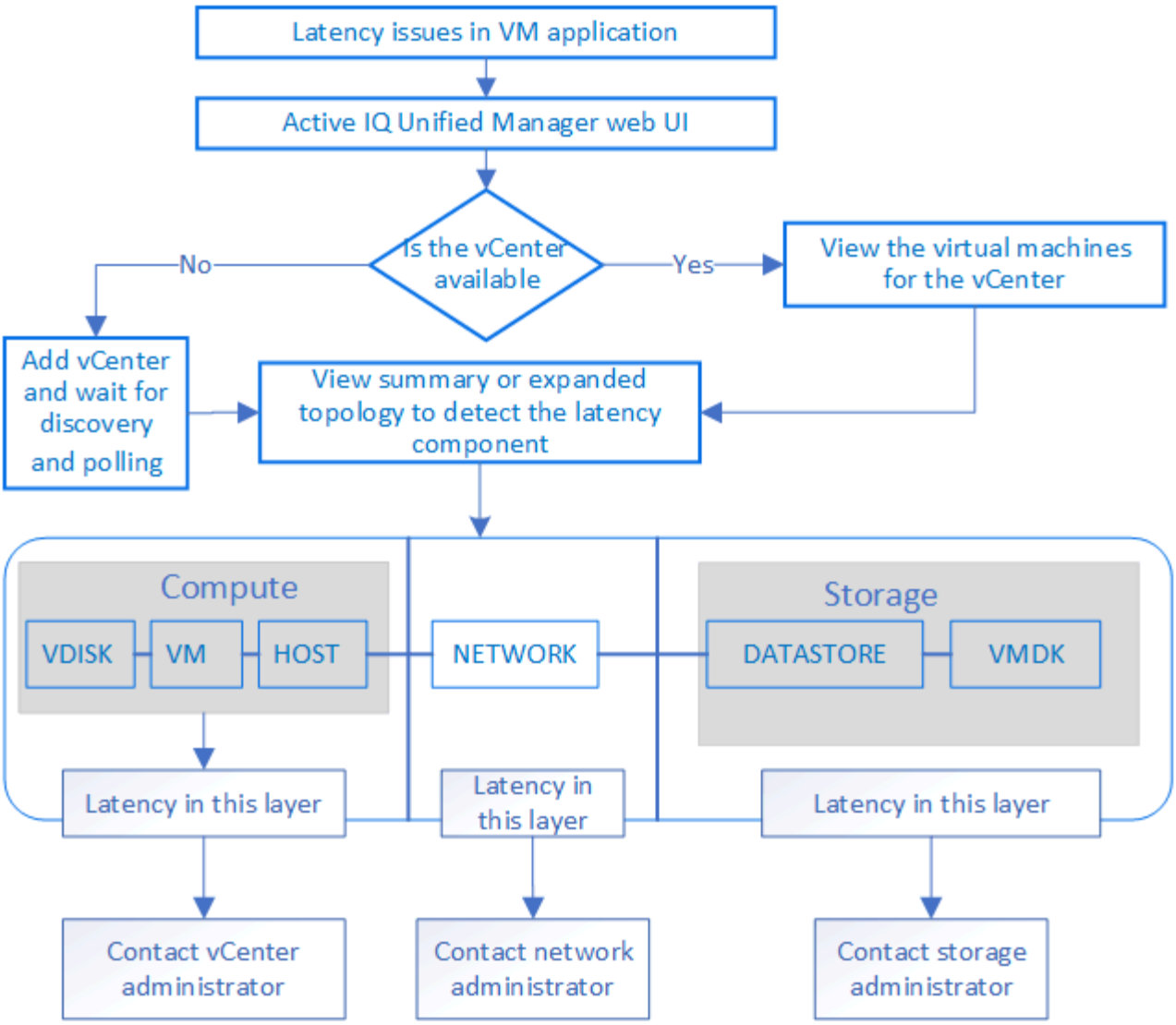
These objects are represented in a VM topology view.

**VMware virtualization on ONTAP**




**User workflow**

The following diagram displays a typical use case of using the VM topology view:




# What is not supported

- Datastores that are outside of ONTAP and are mapped to the vCenter Server instances are not supported on Unified Manager. Any VMs with virtual disks on those datastores are also not supported.
- A datastore that spans across multiple LUNs is not supported.
- Datastores using Network address translation (NAT) for mapping data LIF (access endpoint) are not supported.
- Exporting volumes or LUNs as datastores on different clusters with same IP addresses in a mulitple LIFs configuration, is not supported as UM is unable to identify which datastore belongs to which cluster.

  Example: Suppose cluster A has datastore A. Datastore A is exported via data LIF with same IP address x.x.x.x and VM A is created on this datastore. Similarly, cluster B has datastore B. The datastore B is exported via data LIF with same IP address x.x.x.x and VM B is created on the datastore B. UM will neither be able to map the datastore A for VM A's topology to corresponding ONTAP volume/LUN nor map VM B.

- Only NAS and SAN volumes (iSCSI and FCP for VMFS) are supported as datastores, virtual volumes (vVols) are not supported.
- Only iSCSI virtual disks are supported. Virtual disks of NVMe and SATA types are not supported.

- The views do not allow you to generate reports for analysing the performance of the various components.
- For the storage virtual machine (storage VM) disaster recovery (DR) setup that is supported for only virtual infrastructure on Unified Manager, the configuration has to be manually changed in vCenter Server to point to the active LUNs in switchover and switchback scenarios. Without a manual intervention, their datastores become inaccessible.

# Viewing and adding vCenter Server

For viewing and troubleshooting the performance of the virtual machines (VMs), the associated vCenter Servers must be added on your Active IQ Unified Manager instance.

**What you'll need**

Before adding or viewing vCenter Servers, ensure the following:

- You are aware of the vCenter Server names.
- You know the IP address of vCenter Server and have the required credentials. The credentials must be of a vCenter Server administrator or a root user with read-only access to vCenter Server.
- The vCenter Server that you want to add runs vSphere 6.5 or later.
- The data collection setting in vCenter Server is set to the statistics level of *`Level 3`*, ensuring the required level of metrics collection for all the monitored objects. The interval duration should be *`5 minutes`*, and the save period should be *`1 day`*.

  For more information, see "Data Collection Levels" section of *vSphere Monitoring and Performance Guide* in VMware documentation.

- The latency values in vCenter Server are configured in milliseconds, and not in microseconds, for successful calculations of the latency values.
- While adding the datastore to vCenter Server, you can use both the IP address of the host or the fully qualified domain name (FQDN). In case you are adding FQDN, ensure that the domain name can be resolved by the Unified Manager server. For example, for a Linux installation, ensure that the domain name is added in the `/etc/resolv.conf` file.
- The current time of vCenter Server is in sync with the vCenter Server time zone.
- vCenter Server is reachable for a successful discovery.
- You have the read access to VMware SDK when adding the vCenter Server to Unified Manager. This is required for configuration polling.

For every vCenter Server added and discovered, Unified Manager collects the configuration data, such as the vCenter Server and ESXi server details, ONTAP mapping, datastore details, and number of VMs hosted. It further collects the performance metrics of the components.

**Steps**

1. Go to **VMWARE** > **vCenter**, and check whether your vCenter Server is available on the list.

   If your vCenter Server is not available, you must add vCenter Server.

   a. Click **Add**.

   b. Add the correct IP address for vCenter Server and ensure that the device is reachable.

c. Add the user name and password of the administrator or root user with read-only access to vCenter Server.

d. Add the custom port number if you are using any port other than the default 443.

e. Click **Save**.

Upon successful discovery, a server certificate is displayed for you to accept.

When you accept the certificate, vCenter Server is added to the list of available vCenter Servers. Adding the device does not result into data collection for the associated VMs, and the collection occurs at the scheduled intervals.

2. If your vCenter Server is available on the **vCenters** page, check its status by hovering your mouse over the **Status** field to display whether your vCenter Server is performing as expected or whether there is a warning or error.

Adding vCenter Server allows you to view the following statuses. However, the performance and latency data of the corresponding VMs might take up to an hour after adding vCenter Server to be accurately reflected.

- Green: "Normal", indicating that vCenter Server has been discovered, and performance metrics have been successfully collected
- Yellow: "Warning" (for example, when the statistics level for vCenter Server has not been set to 3 or above to obtain statistics for each object)
- Orange: "Error" (indicates any internal errors, such as exception, failure in configuration data collection, or vCenter Server being unreachable) You can click the column display icon (**Show/Hide**) to view the status message for a vCenter Server status and troubleshoot the issue.

3. In case vCenter Server is unreachable or the credentials have changed, edit the vCenter Server details by selecting **vCenter** > **Edit**.
4. Make the necessary changes on the **Edit VMware vCenter Server** page.
5. Click **Save**.

**vCenter Server data collection begins**

vCenter Server collects real-time 20-second performance data samples and rolls them up to 5-minute samples. The schedule for performance data collection of Unified Manager is based on the default settings of vCenter Server. Unified Manager processes the 5-minute samples obtained from vCenter Server and calculates an hourly average of the IOPS and latency for the virtual disks, VMs, and hosts. For datastores, Unified Manager calculates an hourly average of the IOPS and latency from samples obtained from ONTAP. These values are available at the top of the hour. The performance metrics are not available immediately after vCenter Server is added, and is available only when the next hour starts. Performance data polling begins on completing a cycle of configuration data collection.

For polling vCenter Server configuration data, Unified Manager follows the same schedule as for collecting cluster configuration data. For information about vCenter Server configuration and performance data collection schedule, see "Cluster configuration and performance data collection activity".

**Related information**

Cluster configuration and performance data collection activity

# Monitoring virtual machines

For any latency issue on the virtual machine (VM) applications, you might need to monitor the VMs to analyze and troubleshoot the cause. The VMs are available when their vCenter Server and the ONTAP clusters hosting the VM storage are added to Unified Manager.

You see the details of the VMs on the **VMWARE** > > **Virtual Machines** page. Information, such as the availability, status, used and allocated capacity, network latency, and the IOPS and latency of the VM, datastore, and host is displayed. For a VM supporting multiple datastores, the grid shows the metrics of the datastore with the worst latency, with an asterisk icon (*) indicating additional datastores. If you click on the icon, the metrics of the additional datastore is displayed. Some of these columns are not available for sorting and filtering.

For viewing a VM and its details, the discovery (polling or metrics collection) of the ONTAP cluster must be complete. If the cluster is removed from Unified Manager, the VM is no longer available, after the next cycle of discovery.

From this page, you can also view the detailed topology of a VM, displaying the components to which the VM is related, for example, the host, virtual disk, and datastore connected to it. The topology view displays the underlying components in their specific layers, in the following order: **Virtual Disk** > **VM** > **Host** > **Network** > **Datastore** > **VMDK**.

You can determine the I/O path and component-level latencies from a topological aspect and identify whether storage is the cause of the performance issue. The summary view of the topology displays the I/O path, and highlights the component that has IOPS and latency issues for you to decide on the troubleshooting steps. You can also have an expanded view of the topology that depicts each component separately along with latency of that component. You can select a component to determine the I/O path highlighted through the layers.

## Viewing summary topology

To determine performance issues by viewing the VMs in a summary topology:

1. Go to **VMWARE** > **Virtual Machines**.
2. Search for your VM by typing its name in the search box. You can also filter your search results based on specific criteria by clicking on the **Filter** button. However, If you cannot find your VM, ensure that the corresponding vCenter Server has been added and discovered.

   vCenter Servers allow special characters (such as %, &, *, $, #, @, !, \, /, :, *, ?, "`, <, >, |, ;, ') in the names of vSphere entities, such as VM, cluster, datastore, folder, or file. The VMware vCenter Server and ESX/ESXi Server do not escape special characters used in the display names. However, when the name is processed in Unified Manager, it is displayed differently. For example, a VM named as `%$VC_AIQUM_clone_191124%` in vCenter Server is displayed as `%25$VC_AIQUM_clone_191124%25` in Unified Manager. You must keep a note of this issue when you query a VM with a name having a special characters in it.

3. Check the status of the VM. The VM statuses are retrieved from vCenter Server. The following statuses are available. For more information about these statuses, see VMware documentation.
   - Normal
   - Warning

- Alert
- Not monitored
- Unknown

4. Click the down arrow beside the VM to see the summary view of the topology of the components across the compute, network, and storage layers. The node that has latency issues is highlighted. The summary view displays the worst latency of the components. For example, if a VM has more than one virtual disk, this view displays the virtual disk that has the worst latency among all the virtual disks.
5. To analyze the latency and throughput of the datastore over a period of time, click the **Workload Analyzer** button on top of the datastore object icon. You go to the Workload Analysis page, where you can select a time range and view the performance charts of the datastore. For more information about workload analyzer, see *Troubleshooting workloads using the workload analyzer*.

## Viewing expanded topology

You can drill down to each component separately by viewing the expanded topology of the VM.

**Steps**

1. From the summary topology view, click **Expand Topology**. You can see the detailed topology of each component separately with the latency numbers for each object. If there are multiple nodes in a category, for example multiple nodes in the datastore or VMDK, the node with worst latency is highlighted in red.
2. To check the IO path of a specific object, click on that object to see the IO path and the corresponding mapping. For example, to see the mapping of a virtual disk, click the virtual disk to view its highlighted mapping to the respective VMDK. In case of a performance lag of these components, you can collect more data from ONTAP and troubleshoot the issue.

Metrics are not reported for VMDKs. In the topology, only the VMDK names are displayed, and not metrics.

**Related information**

Troubleshooting workloads using the workload Analyzer

# Viewing virtual infrastructure in a disaster recovery setup

You can view the configuration and performance metrics of the datastores hosted in a MetroCluster configuration or storage virtual machine (storage VM) disaster recovery (SVM DR) setup.

On Unified Manager, you can view the NAS volumes or LUNs in a MetroCluster configuration that are attached as datastores in vCenter Server. The datastores hosted in a MetroCluster configuration are represented in the same topological view as a datastore in a standard environment.

You can also view the NAS volumes or LUNs in a storage VM disaster recovery configuration that are mapped to the datastores in vCenter Server.

## Viewing datastores in MetroCluster configuration

Note the following prerequisites before viewing datastores in a MetroCluster configuration:

- In an event of switchover and switchback, the discovery of the primary and secondary clusters of the HA pair, and vCenter Servers should be complete.
- The primary and secondary clusters of the HA pair, and vCenter Servers must be managed by Unified Manager.
- The required setup must be completed on ONTAP and vCenter Server. For information, see ONTAP and vCenter documentation.

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Follow these steps for viewing datastores:

1. On the **VMWARE** > **Virtual Machines** page, click the VM that hosts the datastore. Click the **Workload Analyzer** or the datastore object link. In the standard scenario when the primary site hosting the volume or LUN is functioning as expected, you can see the vServer cluster details of the primary site.
2. In case of a disaster, and a consecutive switchover to the secondary site, the datastore link points to the performance metrics of the volume or LUN in the secondary cluster. This is reflected after the next cycle of clusters and vServer discovery (acquisition) is complete.
3. After a successful switchback, the datastore link again reflects the performance metrics of the volume or LUN in the primary cluster. This is reflected after the next cycle of clusters and vServer discovery is complete.

## Viewing datastores in storage VM disaster recovery configuration

Note the following prerequisites before viewing datastores in a storage VM disaster recovery configuration:

- In an event of switchover and switchback, the discovery of the primary and secondary clusters of the HA pair, and vCenter Servers should be complete.
- Both the source and destination cluster and storage VM peers should be managed by Unified Manager.
- The required setup must be completed on ONTAP and vCenter Server.
  - For NAS (NFS and VMFS) datastores, in case of a disaster, the steps include bringing up the secondary storage VM, verifying the data LIFs and routes, establishing lost connections on vCenter Server, and starting the VMs.

    For a switchback to the primary site, the data between the volumes should be synced before the primary site starts serving the data.

  - For SAN (iSCSI and FC for VMFS) datastores, vCenter Server formats the mounted LUN in a VMFS format. In case of a disaster, the steps include bringing up the secondary storage VM, verifying the data LIFs and routes. If the iSCSI target IPs are different from the primary LIFs, they need to be manually added. The new LUNs should be available as devices under the iSCSI adapter of the storage adapter of the host. Thereafter, new VMFS datastores with the new LUNs should be created and the old VMs registered with new names. The VMs must be up and running.

    In case of a recovery, the data between the volumes should be synced. New VMFS datastores should again be created using the LUNs and the old VMs registered with new names.

    For information about the setup, see ONTAP and vCenter Server documentation.

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Follow these steps for viewing datastores:

1. On the **VMWARE** > **Virtual Machines** page, click the VM inventory that hosts the datastore. Click the datastore object link. In the standard scenario, you can see the performance data of the volumes and LUNs in the primary storage VM.
2. In case of a disaster, and a consecutive switchover to the secondary storage VM, the datastore link points to the performance metrics of the volume or LUN in the secondary storage VM. This is reflected after the next cycle of clusters and vServer discovery (acquisition) is complete.
3. After a successful switchback, the datastore link again reflects the performance metrics of the volume or LUN in the primary storage VM. This is reflected after the next cycle of clusters and vServer discovery is complete.

## Unsupported scenarios

- For a MetroCluster configuration, note the following limitations:
  - Clusters in only the `NORMAL` and `SWITCHOVER` states are taken up. Other states, such as `PARTIAL_SWITCHOVER, PARTIAL_SWITCHBACK`, and `NOT_REACHABLE` are not supported.
  - Unless Automatic Switch Over (ASO) is enabled, if the primary cluster goes down, the secondary cluster cannot be discovered, and the topology continues to point to the volume or LUN in the primary cluster.
- For a storage VM disaster recovery configuration, note the following limitation:
  - A configuration with Site Recovery Manager (SRM) or Storage Replication Adapter (SRA) enabled for a SAN storage environment is not supported.

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